National Geospatial-Intelligence Agency

2004 Semantic Markup and Exploitation of Geospatial Products

Broad Agency Announcement #HM1582-04-BAA-0005

INTRODUCTION

This Broad Agency Announcement (BAA) solicits offers for the award of procurement contracts for research in Geospatial Semantic Web technologies and Agent-Based Evidence Assembly and Marshalling for Geospatial Analysis. The Basic and Applied Research Branch of the National Geospatial Intelligence Agency (NGA) InnoVision Directorate has a need for new approaches to these areas.

This BAA is being publicized at www.fedbizopps.gov and www.nga.mil (click on Business Opportunities.)

GENERAL INFORMATION

NGA expects to award up to $1 million in procurement contracts in several specific research areas. All awards will be based on merit competition. Depending on the quantity and quality of proposals received, NGA may elect not to make any award(s) under a particular research area. NGA reserves the right to award all, some or none of the proposal received. All responsible sources capable of satisfying the Government's needs may submit a proposal for consideration by NGA. Awards made under this BAA will comply with export control laws related to export of and foreign access to U.S. Government-funded technology development.

It is anticipated that awards will be for a base period of one year, plus two (2) one-year options for a total period of performance not to exceed three years. Proposals for a base period of one year or a base period plus one (1) option will also be accepted. Awards will be made at funding levels commensurate with the research and in response to Agency missions. The number of contracts awarded is subject to the availability of funds, but it is anticipated that one or two awards in each research area will be made this year. Base period awards are expected to be in the range of $250,000-$500,000 per award. The total amount of any award, including option years, will not exceed $950,000. Negotiations may result in funding levels or periods of performance more or less than originally proposed.

Note: Only procurement contracts will be awarded as a result of this BAA. Grants, cooperative agreements, and/or other forms of federal assistance will not be awarded.

AREAS OF INTEREST

The National Geospatial-Intelligence Agency (NGA) provides Geospatial Intelligence in all its forms, and from whatever source – imagery, imagery intelligence, and geospatial data and information – to ensure the knowledge foundation for planning, decision, and action. NGA provides access to Geospatial Intelligence databases for all stakeholders and creates tailored, customer-specific Geospatial Intelligence, analytic services, and solutions. Doing this requires dealing with massive quantities of information from multiple sources, under intense time pressures, for a number of customers.

NGA faces significant technical challenges in managing and exploiting the information available to it. For example, current systems that manage data and associated metadata tend to be stovepiped and interoperability between such systems is problematic. The value added to geospatial products by analysts is usually encapsulated with derivative products and not tied back to the original sources. Geospatial and Imagery Analysts use a variety of tools to assist them in their tasks, but the analysis process remains very labor intensive, with little or no automated analysis support. New, automated analysis capabilities will be needed to supplement and support the work of human analysts in a world awash in data and threats but impoverished of time to analyze the data and identify the threats.

This BAA focuses on two research areas: (1) Geospatial Semantic Web, and (2) Agent-based Evidence Assembly and Marshalling for Geospatial Analysis. Proposals outside these areas will not be considered. Researchers should be prepared to operate independently and to supply their own data -- geospatial and otherwise. Proposals that require Government furnished data will not be accepted.

DISCUSSION OF RESEARCH AREAS

NGA's research interests are discussed in detail below. An award in any area will be made only if a sufficiently meritorious proposal is received. NGA reserves the right to allocate available funds among areas of interest based on the quality of the responses and NGA priorities. An area of interest may have no awards, a single award or multiple awards.

Area 1: Geospatial Semantic Web

Approximately $500,000 of the available funds will be allocated to this area of interest.

Locating geospatial intelligence products (e.g., imagery, NGA Imagery Intelligence Briefs, cables) presently relies on traditional search technology based on associated text and annotations of products or basic metadata queries over parameters such as location, date, and source. The discovery of problem-relevant data requires knowledge of sources and usually requires specification of queries based on the nature of the data rather than on the nature of the problems.

There is presently no consistent mechanism for maintaining data pedigrees – computer exploitable documentation of how products have been exploited and of what products were used

in a given analysis. Consequently there is no simple way to determine when derivative products are affected by updated source information. The maintenance and integration of multiple sources is hindered by metadata definitions that are often rigidly tied to the related products and not readily exploitable across products. The modification, evolution and integration of these metadata schemata can be very problematic

As new data sources become available and response timelines are shortened, new capabilities are needed to ensure that intelligence analysts have timely access to the right data for their tasks and that they are aware of, and have access to all of the relevant data that is available.

Proposals should address some aspects of the following research sub-areas. Proposals that credibly address multiple sub-areas are highly desirable:

1) Exploit semantic markup of geospatial-intelligence products by using geospatial and problem-specific ontologies and rules in support of Problem-Responsive Discovery and Retrieval of geospatial products. Rather than requiring an analyst to search for information by the geographic coordinates and product characteristics of interest, research in this area would demonstrate the ability to search for information that is responsive to the needs of an analytical task such as "locate instances of mobile air defense deployments near fixed communications facilities in the northern part of country X."

2) Support the creation and management of semantic markup of geospatial data and intelligence products. Issues addressed in this research area may include accommodating automatic and manually created markup; maintaining data pedigree and provenance (i.e., what has been done to data as it is processed and handled); the capture, maintenance and exploitation of post-production markup – reification of markup; and the use of ontologies to abstract and integrate disparate metadata representations.

3) Research that addresses the use of multiple ontologies and changing ontologies. While multiple ontologies may include competing, independent representations of a domain, the primary interest is in representations of multiple domains that are appropriate to a problem. An example of multiple distinct ontologies is a geospatial ontology for places and proximity, a target ontology for facilities and structures, and a source ontology for sensor platforms.

4) As new information is gathered about a domain, ontologies will be extended and, in some cases, changed. Thus systems will need to deal with multiple versions of a given ontology. Research is needed into how reasoning systems that use these ontologies will accommodate representations that change over time.

Area 2: Agent-Based Evidence Assembly and Marshalling

Approximately $500,000 of the available funds will be allocated to this area of interest.

NGA has funded basic research to explore the viability of agent-based systems with fixed, geospatially-oriented agents. Current imagery and geospatial data may have resolutions on the

order of one meter. With the area of a moderate sized land area being about one trillion square meters, precisely locating an intelligence target can literally be equal to the challenge of finding one location within a trillion potential locations. While current agent-based systems can simultaneously run one million agents with fixed areas of responsibility, this approach may not scale another six orders of magnitude.

This research has investigated applying such agent models to assist with automated deduction for answering intelligence problems, sensor tasking and optimization, and information conflation, sorting, and triage. NGA is now seeking proposals that address limitations identified in this previous research and lead to systems that can scale to monitor and conflate all information, geospatial or otherwise, within a terapixel area of interest in near real time so that valuable nuggets of information and actionable inferences and conclusions can be displayed to an analyst. NGA is particularly interested in receiving proposals that present credible plans and timeframes for transitioning these research products into production-quality products.

Research proposals should address some aspects of the following sub-areas. Proposals that credibly address multiple sub-areas are highly desirable:

1) Scalability of geospatially-aware multiagent systems.
    a) Accommodate tasks that ultimately require spatial resolution to 1 part in 10^{12}.
    b) Partitioning of multiagent systems to run on parallel, cluster, and grid computing architectures.
    c) Interagent communications strategies that can accommodate very large numbers of agents in distributed computing environments.
2) Conflating information from multiple sources and of multiple types (i.e., multiINT reasoning).
3) Working with information pedigrees, sparse, uncertain and contradictory information.
4) Automated explication of results.
5) Automated inference from available data, especially the exclusion of further information in areas that look to be of low intelligence value.
6) Determination of new, high value intelligence targets based on available information.

CONDITIONS

This competition is specifically for the research interest areas described above. Offerors are advised to read this announcement carefully, as it explains NGA's research needs upon which the areas of interest are based and the terms and conditions of the competition.

NGA encourages and accepts proposals from industry and universities. Offerors who propose a

teaming arrangement must name one Principal Investigator as the responsible technical point-of-contact. If two or more institutions collaborate on a proposal, the proposal must describe the relationship among the institutions and their respective roles, as well as the apportionment of funds among institutions, in both the proposal text and the budget. Cost sharing by industrial and university participants is encouraged.

The Government will receive Government purpose Rights to Technical Data and Computer Software developed and delivered under this contract.

PROPOSAL FORMAT AND REQUIREMENTS

General

NGA intends to award all available FY04 funds. To be considered and evaluated, the full proposal must be received by the Government by the due time and date as identified in this BAA. Proposals received after the closing date will be treated according to Federal Acquisition Regulation part 15.208.

The Government will evaluate all proposals submitted under the terms and conditions of this BAA. Proposals will be evaluated against the criteria identified under the "Evaluation Criteria" portion of this BAA. NGA seeks to award Cost Plus Fixed Fee (CPFF) contracts. The estimated period of performance is as follows:

Base Year: 1 October 2004 – 30 September 2005
Option Year 1: 1 October 2005 – 30 September 2006
Option Year 2: 1 October 2006 – 30 September 2007

For proposal preparation purposes, use the estimated award start date identified above or the proposed start date, whichever is later.

Content

Proposals must be complete and self-contained to qualify for review. Proposals shall be prepared single-spaced in 12 point Times New Roman font, with at least one inch margins on top, bottom and sides, for printing on 8½" by 11" paper. The proposal shall include the items identified below. Separate attachments, such as institutional brochures or reprints that are not germane to the proposal, are discouraged.

1) Cover Page – 1 page

The cover page shall include the BAA number HM1582-04-BAA-0005, proposal title, NGA research area of interest and relevant section. Although not encouraged, if a single proposal spans both areas, please ensure the areas of interest are clearly identified. The cover page must also indicate the name, phone number, fax number, postal address, and e-mail address of both the Principal Investigator AND an appropriate contract administrator.

2) Executive Summary – Not to exceed 2 pages

This shall summarize the significant and important characteristics, approaches and proposed research to further the objectives in the relevant area.

3) Technical Proposal – Not to exceed 10 pages

Technical proposals shall accomplish the following:

A. Describe in detail the research to be undertaken. State the objectives and approach and the relationship to state-of-knowledge in the field and to similar work in progress. Include appropriate literature citations and prior work. Discuss the nature of expected results.

B. Discuss the offeror's current and/or previous accomplishments/work in this or closely related research areas.

C. Include a description of the results, products, transferable technology, and strategy for effectively transitioning results from the project to the Government.

D. Describe the facilities available for accomplishing the research objectives. Describe any equipment proposed for acquisition under this program and its application to the research objectives.

E. Identify other parties to whom the proposal has been/will be sent.

4) Key Personnel – Not to exceed 4 pages

Describe the qualifications of the Principal Investigator and the qualifications of other key researchers involved in the project. Include resumes for all key personnel proposed.

5) Cost Proposal – 5-15 pages recommended

The financial portion of the proposal, beginning on a new page, should contain cost estimates in sufficient detail for meaningful evaluation, including cost details for proposed sub-awards. The cost proposal must include the total cost of the project, as well as a breakdown of the amount(s) by source(s) of funding (e.g., funds requested from NGA, non-federal funds and/or institutional funds to be provided as cost sharing, etc.) The costs should be broken down for each year of the program and shown by three distinct totals: a total for the base year and a

total for each of the two option years. Costs for entertainment, amusement, diversion and social activities and any costs directly associated with such activities are unallowable. Include the name, address and telephone number of the offeror's cognizant Defense Contract Audit Agency (DCAA) audit office (if available). There is no page limit for the cost section of the proposal but 5-15 pages is recommended. This section shall include statements as to the basis of estimate for all proposed costs. Cost elements should include, but are not limited to:

A. Estimated number of hours by labor category (principal investigator, colleagues, graduate students, etc.) and the hourly rate. Allowable charges for graduate students include salary, appropriate research costs, and tuition. Allowable charges for undergraduate students include salary and research training costs, but not tuition.

B. Costs of equipment: based on most recent quotations and broken down in sufficient detail for evaluation (equipment costs should be budgeted primarily during the first year). Allowable equipment will ordinarily be limited to research equipment and apparatus not already available for the conduct of the work. General-purpose equipment, such as a personal computer, is not eligible for support unless primarily or exclusively used in the actual conduct of the proposed scientific research.

C. Travel costs and time, and the relevance to stated objectives. This shall include a breakdown of the number of travelers, location, and duration; and estimated costs for transportation, rental car and per-diem.

D. Other direct costs: materials and supplies; publication, documentation and dissemination; consultant services; computer services; communication costs not included in overhead; other (identify).

E. Sub-award costs and type (the portion of work to be sub-awarded and rationale); note that the sub-award of funds among university and industry performers responding as one consortium must be described carefully in both the text and the cost section.

F. Indirect costs.

G. Profit/fee.

EVALUATION CRITERIA

Evaluation of proposals will be accomplished through a peer or scientific review process using the evaluation criteria listed below. The evaluation criteria are ranked in order of relative importance. Criterion A is the primary evaluation criteria and is more important than Criterion B. Criterion B is more important than Criterion C. Criterion C is of equal importance as

Criterion D.

A. Overall scientific and/or technical merit, including technical feasibility, degree of innovation, understanding of the technical and operational approach, and experimental approach. If a proposal lacks overall scientific and/or technical merit, it will not be further considered for award.

B. Qualifications, capabilities, and experience of key personnel.

C. Offeror's plan for transitioning from research to prototype and product.

D. Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these, which are integral factors for achieving proposal objectives.

The Government will also evaluate whether the proposed costs for the effort are realistic and reasonable, and the value of the proposed effort considering the proposed total cost of the effort. Proposed cost sharing in the effort by an offeror will be considered an added value of the proposal.

Finally, the performance risk of a proposed effort will be evaluated based on the nature of the proposed effort and the previous performance of the offeror on similar efforts, if any.

SELECTION PROCESS

The evaluation process will consist of the following steps:

A. Proposals will be grouped together by area of interest. An evaluation team comprised of Government technical experts will perform an initial technical evaluation of all proposals in the same group and score them against the evaluation criteria set forth above.

B. Next, the entire Evaluation Team will consider the overall contribution of each proposal as reflected by the evaluation scores, the potential contribution to the advancement of the targeted area of interest, the amount of similar or related research currently underway on a given area, and the amount of available funding. This step reconciles recommendations about proposals spanning more than one technical area, and allows for strategic consideration of the diversity of proposals across the areas of interest. It is NGA's intent to distribute awards across both areas of interest if enough proposals are found selectable.

C. The Evaluation Team will forward a list of proposals recommended for award ranked in order of preference, along with a description and results of the evaluation process, to the Director of Basic and Applied Research Office (IB) for source selection decision.

D. Once the source selection is made, the final award list will be forwarded to the Contract Specialist for negotiation and award action.

In summary, the Evaluation Team will recommend to the Director of IB the proposals that most

effectively advance the objectives as identified under the areas of interest in this BAA, in accordance with the evaluation criteria. The number of awards made is dependent upon the amount of available funding. If additional funding becomes available from within NGA, or from other U.S. Government agencies, NGA may choose to make additional awards under the terms of this BAA from the remaining selectable proposals. The sponsoring organization will be free to support any proposal(s) not selected for contract award under this BAA that address the research interests of that organization.

PROPOSAL SUBMISSION AND COMMUNICATION

Proposals shall be submitted by e-mail electronically to **sme04@westfields.net**. Proposals shall be formatted ONLY as .pdf files that can be viewed with Adobe Acrobat Reader 5. The total size of e-mail submissions, including attachments, shall not exceed 1.95MB. Compressed proposals formatted as .zip files will be rejected due to potential computer virus considerations. The Government is not responsible for proposals that cannot be submitted because they exceed these size restrictions at any time and for any reason. The signature page may be scanned but all other sections of the proposals must be text searchable. The proposal shall reference BAA number HM1582-04-BAA-0005.

NGA will send an acknowledgment of receipt of the proposal to the originator of the e-mail that forwarded the proposal. After evaluations have been completed by the Evaluation Team and it is time to begin negotiations, NGA will notify originators whether or not a proposal has been selected for an award. Acknowledgment and notification will be sent via e-mail, with a copy to the appropriate proposing office.

To be considered and evaluated, the full proposal must be received by the Government by 3:00 pm, eastern daylight savings time, on 21 July 2004. Proposals received after the closing time will be treated according to Federal Acquisition Regulation Part 15.208.

Note: Only e-mail proposals are allowed. Paper proposals will not be accepted.

CONTRACTING POINT OF CONTACT

All communication concerning BAA number HM1582-04-BAA-0005 shall be through Cathy Lao, the Contract Specialist. NGA encourages use of e-mail for any correspondence relating to this BAA.

Voice: (703) 735-3122

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This Broad Agency Announcement and other information about this BAA may be obtained from www.nga.mil (click on Business Opportunities).